Energy efficient HM Rotor –
Power saving solution for virgin bale repulping applications

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A recently completed demonstration project, funded partly by the Wisconsin Focus on Energy program and Wisconsin Public Service Corporation, was conducted to measure the performance and energy savings of the Voith engineered HM Rotor installed in a virgin furnish repulper at Wausau Paper in Rhinelander, Wisconsin, USA.

Wausau Paper is a leading producer of fine printing and writing, technical speciality and towel and tissue papers. Their Rhinelander, Wisconsin location produces pressure sensitive and protective barrier papers on three paper machines.

Introduction

A multitude of economic forces are presently at work influencing the profitability of paper mills. Rising energy costs contribute to these economic pressures. In addition, non-integrated mills that must purchase their raw paper making fibers are at the mercy of volatile market pulp prices.

Voith designs equipment and solutions to help mills offset their rising operating costs. Many paper mills purchase their raw materials in the form of dried pulp bales for use as their paper making fiber furnish. These mills must make down, or repulp the bales in order to put the pulp fibers into suspension for preparation and delivery to the paper machine. The repulper, used to mix the pulp bales in water is, in simple terms, a large tank with a mixer, or rotor, on the bottom. Energy is applied to the rotor in order to provide agitation that causes the material on top to be drawn below the surface of the water and defibered. A mill typically operates several furnish repulpers, twenty four hours a day, seven days a week.

Repulper rotor blade design is one area of opportunity that Voith has identified to control a mill's operating costs. The energy saving HM Rotor (Fig. 1), a tall, swept-back blade design, has been engineered by Voith to provide effective turbulence of fiber suspensions with maximum rotor-fiber contact while consuming low energy. The HM Rotor is specifically intended for retrofitting existing repulper rotors in North America.

While considering the HM Rotor technology for one of their existing furnish repulpers, Wausau Paper turned to Focus on Energy to verify the energy savings by testing and metering the HM Rotor in comparison with a conventional rotor in the same repulper.

Focus on Energy is a public-private partnership offering energy programs whose goals are to encourage energy efficiency and use of renewable energy, enhance the environment and ensure the future supply

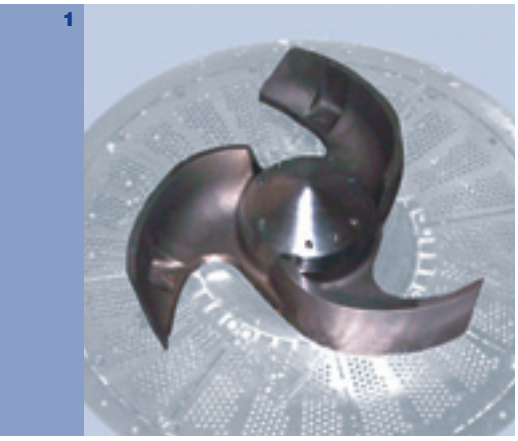

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Fig. 1: *Energy saving HM Repulper Rotor.*

Fig. 2: *The results of six days of power monitoring – conventional versus HM Rotor.*

Fig. 3: *Consistent reduction in energy requirement throughout the pulping time compared with the conventional rotor.*
Furnish: 50/50 bleached hardwood/softwood pulp

of energy. Their services include walk-through audits, project evaluation assistance, measurement and evaluation of savings, financial assistance for stalled projects, training opportunities, tools to manage energy and third-party reviews.

Mill test conditions

The Focus on Energy Program provided a share of the cost to verify savings projections. Wisconsin Public Service Corporation, the local electric supply utility, teamed with Focus on Energy by providing the electrical metering. Voith and Wausau Paper conducted the defibering examination, freeness, fiber quality analysis and other testing.

Wausau Paper uses 50 percent hardwood and 50 percent softwood in their process furnish mix. The mix consists of 100% virgin fiber purchased in the form of dried pulp bales.

The mill used the same furnish recipe throughout all testing performed during our demonstration and all efforts were made to operate the pulper under similar process conditions (operating level, temperature and pulping consistency).

The existing Voith repulper was initially installed at the Rhinelander mill in 1992. The repulper was supplied with a HOG Rotor which, for the purpose of our comparison, is referred to as a "conventional rotor". A new HOG Rotor (not worn) was installed for this test. The repulper operates on a batch basis and is designed to deliver approximately 8,000 lbs of fiber per batch. Pulping time is 15 minutes.

Test procedure

Representatives from Wausau Paper, Voith, Wisconsin Public Service and Focus on Energy met to form a test plan. The goal of our testing was to verify that fibers are separated properly (100% defibered within the existing pulping time), that the new blade had no adverse impact on fiber quality and to record the difference in power consumption between the two blades.

An assessment of the rotors included the conditions inside the pulper and measurements of the gaps to insure proper clearance between the rotor and extraction plate. Electrical use was metered for the test period. The metering recorded the rotor energy (kW) used in 15 minute intervals.

We also recorded motor load amperage readings throughout the pulping time. Pulper grab samples were taken at 4, 6, 10 and 15 minute intervals from startup.

We measured the degree of defibering on all grab samples using two methods. In the first method, a diluted sample was

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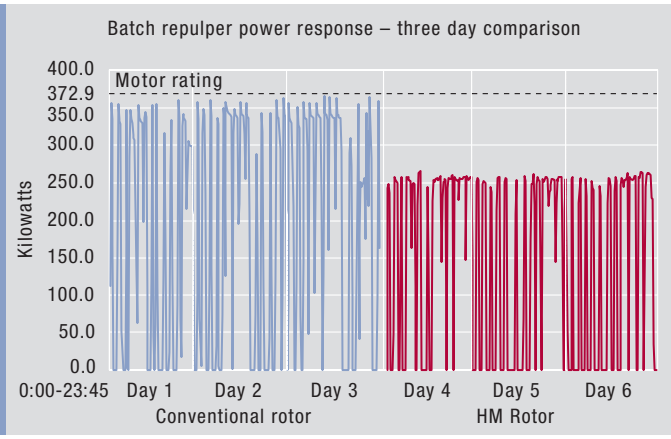

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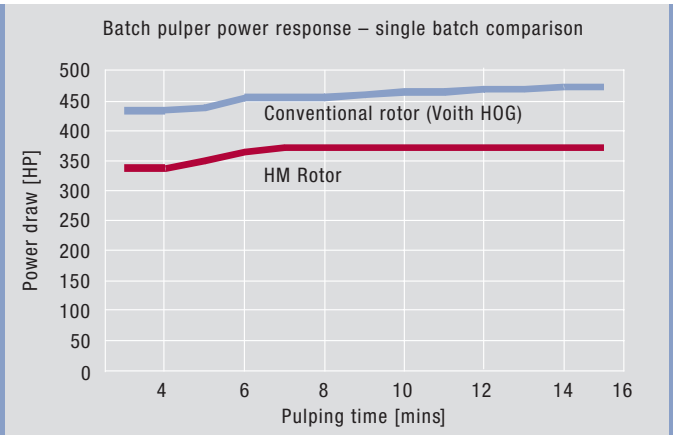

Fig. 4: *Identical defibering characteristics between conventional and HM rotors. Furnish: 50/50 bleached hardwood/softwood pulp*

Fig. 5: *Energy saving HM Rotor summary.*

poured onto a blue glass. Undefibered material on the glass was compared to a Voith Speck Index (VSI) to establish the degree of defibering.

In the second method, hand sheets were made from all grab samples. Undefibered material visible in the dried hand sheet was compared to the VSI to confirm the degree of defibering. Defibering indexes and consistency measurements were made at millsite for all tested pulper batches. In order to compare the impact of the rotors on the pulp fibers, freeness testing and length/fines distributions were performed on the 15 minute grab sample at the lab of Voith in Appleton, Wisconsin.

Results

The gaps between the rotor blade and extraction plate were measured to be within tolerances set by Voith Paper for all test conditions. Fig. 2 shows the results of six days of metering power demand for the conventional rotor versus the HM Rotor. Fig. 3 is generated from amperage draw measurements taken throughout individual pulper batches. Both Figs. 2 and 3 show that average energy demand was consistently reduced by approximately 25% after installing the HM Rotor. Note that peak energy demand throughout the pulper batch was reduced by 28%.

Fig. 4 shows that the HM Rotor provided identical defibering characteristics when compared to the conventional rotor. Comparison of the results of freeness tests and fiber length distributions showed no appreciable differences between conventional rotor and HM rotor batches.

Conclusion

The HM rotor required 25% less energy than a conventional rotor to repulp identical furnishes under similar process situations. This reduction in energy represented cost savings for the mill of US $ 28,000 per year (Fig. 5). The HM Rotor defibered the pulp furnish to the same degree as the conventional rotor without adversely affecting fiber quality. This project, partially funded by Wisconsin's Focus on Energy Program and Wisconsin Public Service verified that the HM Repulper Rotor saves paper mills energy and will significantly lower their operating costs.

Acknowledgement

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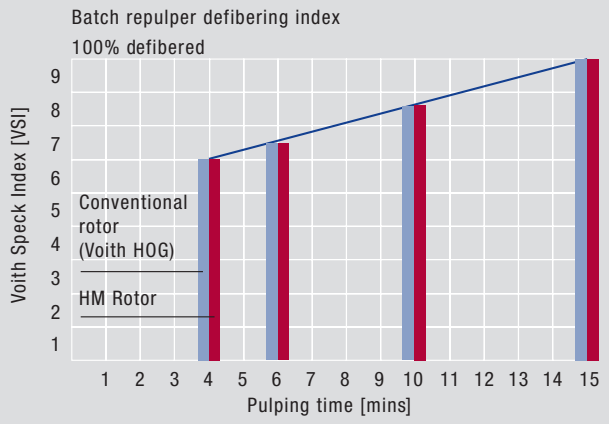

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Summary of energy savings – batch repulper

	Conventional rotor	HM Rotor
Peak consumption [kW]	368	265
Average consumption [kW]	336	259
Batch cycle – fill, pulp, dump		
Motor operation [h/day]	20.8	20.8
kWh/day	6,989	5,387
kWh/year [350 days]	2,446,150	1,885,450
kWh/year saved		560,700
Cost savings [USD]		**28,035**
Energy costs USD 0.05/kWh		